Mobile communications for industrial applications

The key to market success in the future can be found in the provision and availability of information at every location and at all times. Mobile devices networked using fast, wireless LANs permit processes to be designed significantly more efficiently. The advantage of wireless solutions is primarily the simple, flexible accessibility of mobile stations. The MOBIC (Mobile Industrial Communicator), RLM (Radio Link Module) and CP 1515 from **SIMATIC NET** are industry-compatible products which open up the advantages of mobile communications for industrial applications.

MOBIC ® is a mobile Internet pad for local or global access to the intranet and Internet. Plug-in radio cards make the MOBIC mobile for data access locally and at all times. It is industry-compatible thanks to its particularly rugged splash-proof and dust-tight design.

The RLM is a wireless LAN access point with which data communication is possible up to 11 Mbit/s, as well as being free-of-charge and safe. With its rugged metal housing it is appropriate for industrial applications.

The CP 1515 communications processor is a PCMCIA card of type II and is used both as the radio interface in the RLM and as the radio interface in the mobile stations (e.g. MOBIC). The CP 1515 permits communication free-of-charge at a maximum transfer rate of 11 Mbit/s.

Together with the RLM access point and the CP 1515 PCMCIA card, the MOBIC is a solution for a wireless LAN in industrial applications.

Product Brief

mobic

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Wireless communications: the options

Wireless communications is always a good choice if stations are difficult to connect to a wired infrastructure. Such applications include mobile data acquisition in production and logistics, the transmission of service data to mobile terminals, or the commissioning of complex plants using radio-connected programming devices.

A further aspect in favor of the use of mobile communications is the replacement of wired solutions in order, for example, to eliminate the problem of electrical isolation of widely remote communications equipment.

Furthermore, mobile communications can save expensive, time-consuming installation of infrastructure in the case of temporary plants or flexible production plants.

Basic prerequisites for mobile, industrial communications equipment – in addition to wireless connection to the network – include simple operation, compact design, and the ruggedness required by harsh industrial environments.

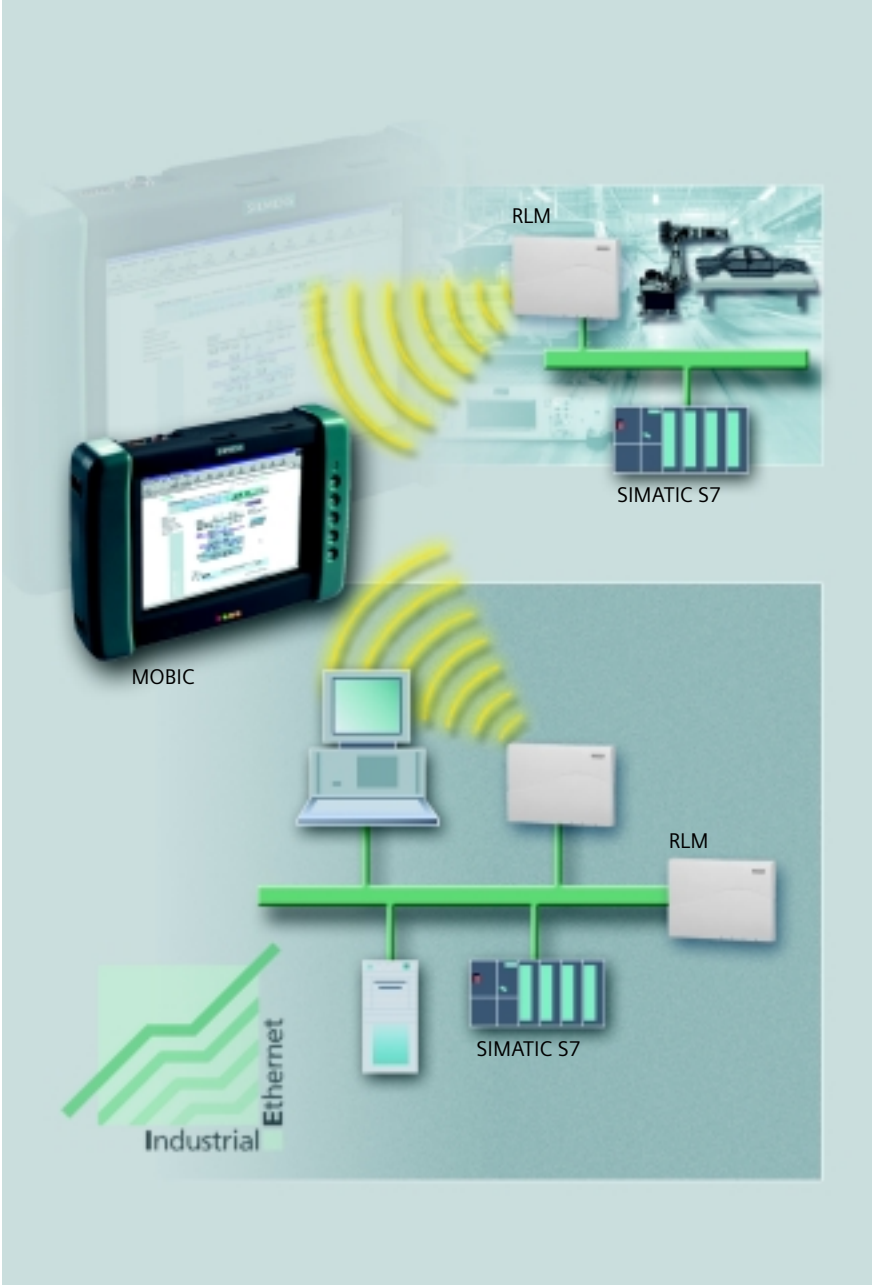

Fig. 1: Seamless integration into existing infrastructure

Possible applications with MOBIC

MOBIC for servicing

Service personnel are provided with fault signals by means of the MOBIC. In addition, specific information can be passed on to the service personnel to facilitate faster troubleshooting. Spare parts can be ordered online, and customers can be informed of accurate delivery dates. For example, maintenance jobs can be directly stored and planned in the central maintenance management system from the place of action. Furthermore, the inventories of stores can be examined, spare parts ordered, and documentation viewed for handling or repair instructions.

- Receive and acknowledge jobs online
- Spare parts lists and manuals are accessible online
- Call updates from server
- Access to worldwide service data
- Select up-to-date circuit diagrams from central server

MOBIC e.g. for security services

MOBIC supports security authorities in their daily mobile operations. Whether trade vehicles, police squad cars, fire services vehicles, ambulances or emergency doctor's vehicles – during mobile operations, data are exchanged by radio, and processed locally in the vehicle. MOBIC can display more information than was previously possible using short texts in the radio signalling system. Instead of just 99 characters, access is possible to databases, networks based on a closed Web, and all data of a central server.

Calculation of costs and billing for health insurance companies are carried out directly following input of data to the MOBIC. Or you can transmit the data occurring during a shift to a central computer for description of the event and calculation of costs in the control centers for rescue services or doctors.

Fig. 2: Possible applications with MOBIC

Police officers can use MOBIC online and locally to process accidents, to document them, and transmit the data to the control center.

Fire services can call the data for hazardous goods from the database, or store operations directly in the MOBIC.

MOBIC is a rugged device appropriate for harsh use by safety services on site.

Possible applications with MOBIC

MOBIC for production

MOBIC can of course be used for efficient planning of servicing, a large field of application in production plants. There are many further applications. In production plants, the technician is provided with servicing data on the local machine from a remote control station. All information required for trouble-shooting can be called locally. In this manner, many situations can be analyzed faster, and down times minimized.

In the case of flexible production systems, down times and the associated reasons are recorded by the production staff using MOBIC. Faults and their causes are automatically evaluated in the central information system.

In the same manner, MOBIC can be used to record machine data in a simple manner, and transmit them immediately to a central server where they are directly evaluated. This is particularly meaningful with plants where automatic recording of machine statuses is non-economic. The result is that plant responses can be improved, and vacant machine capacities utilized better.

In the quality assurance sector, for example, faults in a paint shop can be entered online using MOBIC in a representation of the vehicle. When reworking, these quality data can also be called online and processed specifically. This guarantees interruption-free recording of the quality data.

- Visualization of process data without being bound to a fixed location
- Online documentation also in areas which were previously difficult to access
- Commissioning with optimized time and personnel requirements
- All fault and alarm systems can be viewed independent of the location, even with large plants and machines
- Fast local analysis of situation
- Minimization of down times

Fig. 3: Possible applications with MOBIC

MOBIC for logistics

The relatively high data transfer rate and range of industry-compatible wireless LAN components means that fast networks with blanket coverage can be produced for a location or hall. For example, mobile devices with barcode readers can be used in a warehouse directly at the shelf or truck to immediately record incoming and outgoing goods.

In addition to this, inventories can be examined, new stock ordered, and handling documents viewed and processed online. Central databases can be permanently kept up to date using MOBIC, with low effort and reduced paper requirements.

- Planning of resources
- Display of delivery notes
- Input of incoming/outgoing goods
- Control system for high-lift trucks
- Navigation/GPS

Possible applications with MOBIC

Linking of mobile communications into existing

Wireless LAN components can be integrated without problem into existing Ethernet LANs using an RJ45 connection.

The RLM access point can be used for stand-alone operation, and is mainly connected to a wired Ethernet network. By connecting several RLMs, a wireless network is produced for mobile stations.
When using several RLMs whose ranges overlap, it can be guaranteed that communications to mobile stations remains possible. This is achieved by passing on the communications connection from one access point to the next (roaming).

Web-based network management with MOBIC and OSM/ESM

Network management can be carried out extremely conveniently with MOBIC using browsers. An RLM is connected to an existing Industrial Ethernet, e.g. using an optical switch module (OSM) or electrical switch module (ESM). The RLM implements the wireless communications to the MOBIC.

The OSM or ESM has the following functions for network management:

- Locally on the module:
  Via the CLI (Command Line Interface): serial interface and PC with terminal emulation
- Remote via browser
  (Web-based management):
  Selection of OSM or ESM via the network from a PC with browser
- Remote via SNMP:
  Linking of OSM or ESM via the network to a network management station

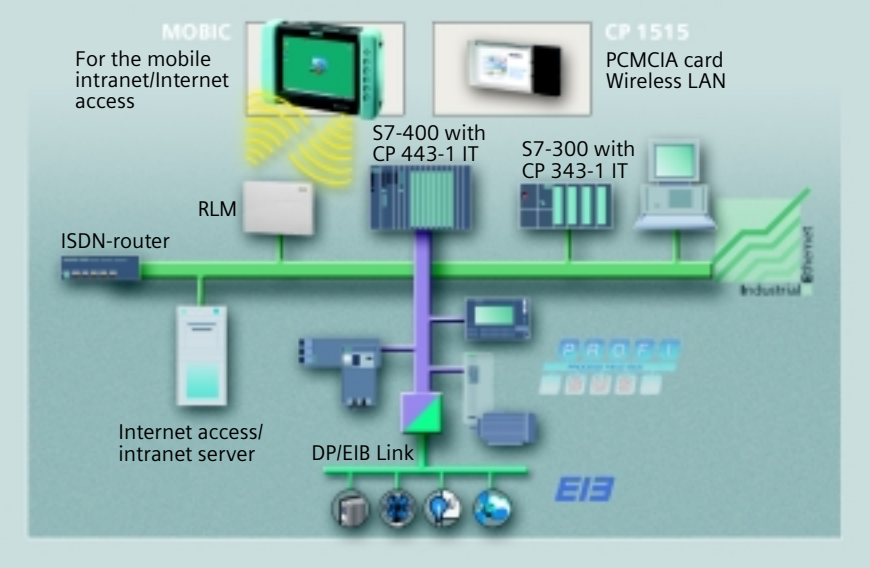

Fig. 4: Linking of existing infrastructures with MOBIC

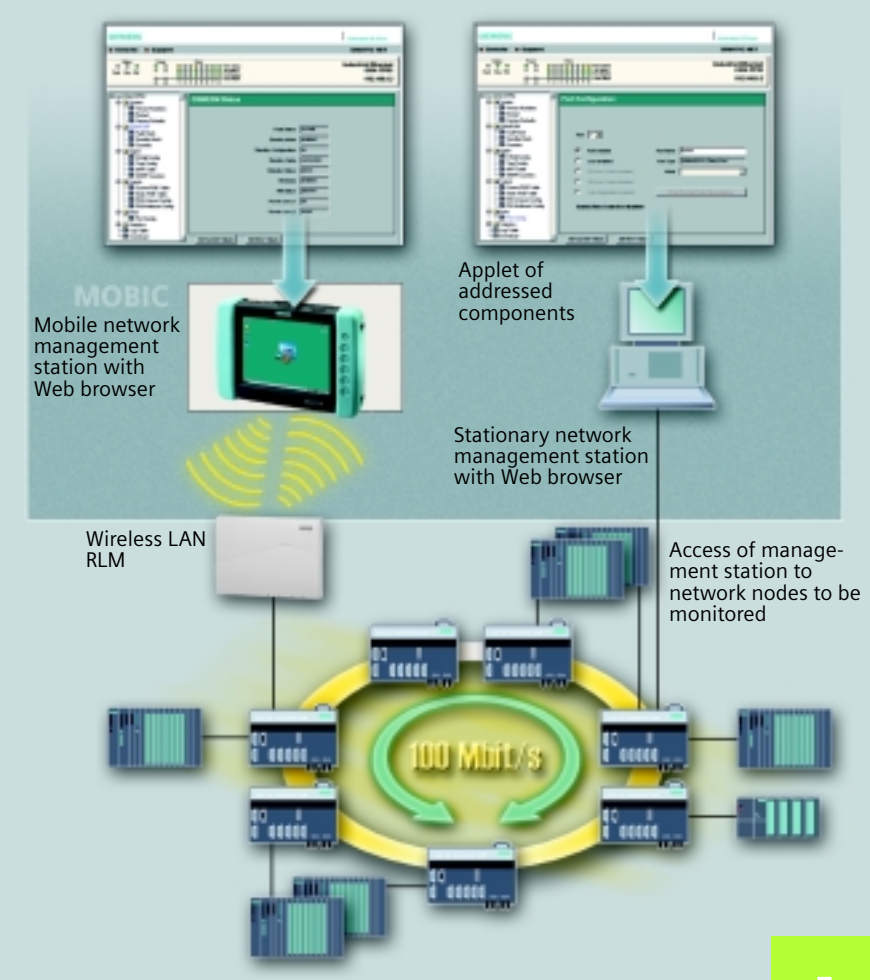
MOBIC
Mobile network management station with Web browser
Applet of addressed components
Stationary network management station with Web browser
Wireless LAN RLM
Access of management station to network nodes to be monitored
100 Mbit/s

Fig. 5: Web-based management with MOBIC and OSM

Vertical integration with MOBIC

MOBIC as a mobile terminal permits an integrated flow of information from the operations management level down to the production level.
This guarantees that information is provided rapidly, securely and in an uncomplicated manner at the right place and at the right time.

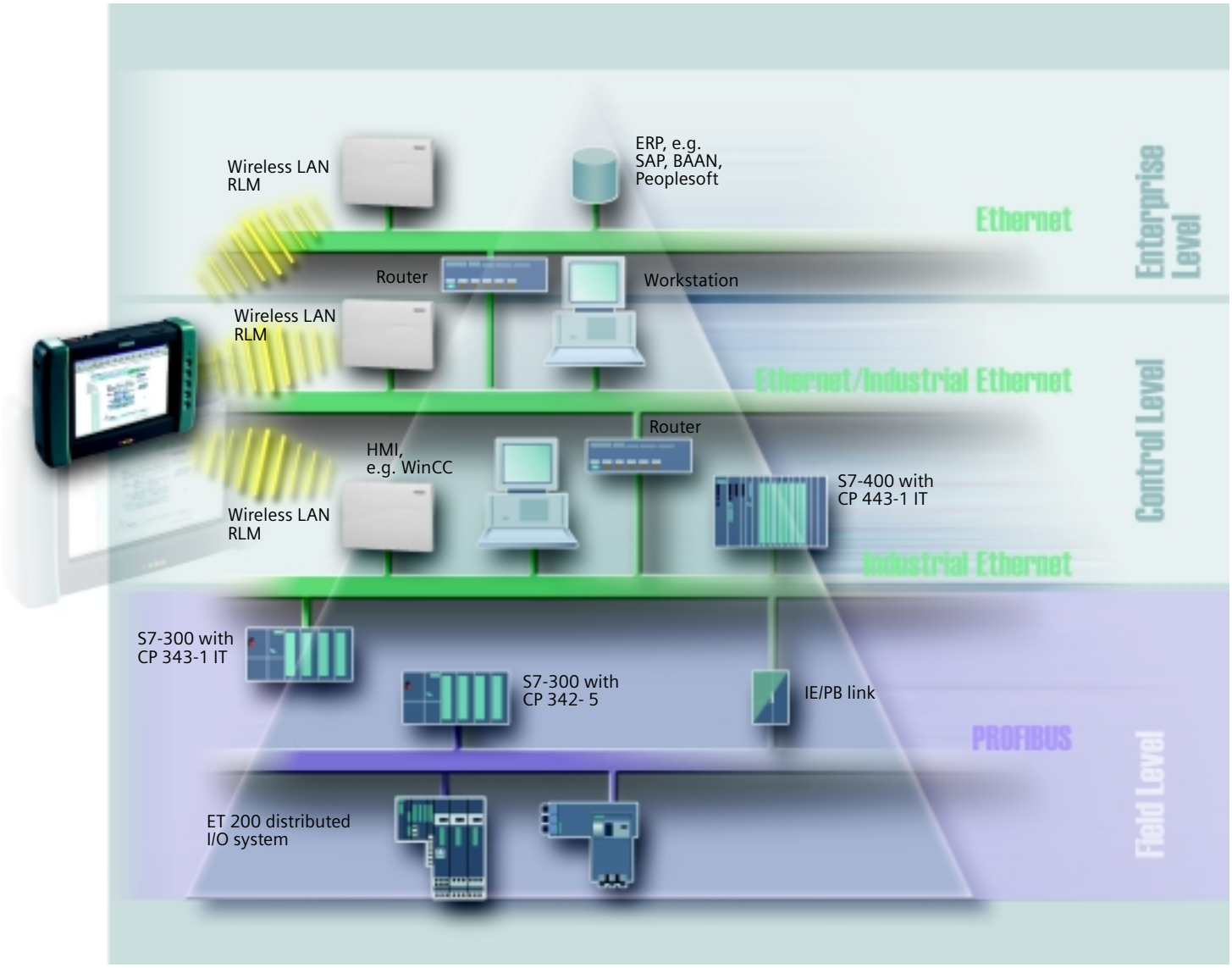

Fig. 6: Integrated flow of information from the operations management level down to the process control level e.g. using MOBIC and thin client applications

Thin client applications

Terminal service with Windows 2000

The principle of thin client/server computing is based on the fundamental physical separation of data, applications and screen output.
The terminal services of Windows 2000 permit execution of specialized sites such as Internet pads as thin client applications or typical office applications in the main memory of a central Windows 2000 terminal server instead of in their own memory.
Clients are operated as terminals in the process which are only used to enter data (using keyboard and mouse) and send these on to a terminal server. The latter carries out the actual processing (e.g. the updating of a process display) in order to send the resulting screen output back to the client PC which in turn is then responsible for display on its screen.

Advantages

- Remote multi-user solutions with any client target systems
- Clients as desired: robust and mobile
- Server in secure environment
- Central software administration
- High performance even with simple client hardware
- Simple expansion possible at any time

The clients can be used even under extremely harsh conditions (vibration, high temperature, splashing water, dust) since they do not require a hard disk or fan. If a client has to be replaced, this can be carried out within an extremely short time. A physical connection between a new, non-configured thin client and the network is required for this. The current session on the server can be taken over without interruption.
Mobile equipment such as the MOBIC is suitable as the client platform. This can be linked using various media e.g. twisted pair Ethernet (10/100 Mbit/s), wireless LAN, or mobile radio.

Fig. 7: Thin client applications with WinCC as example

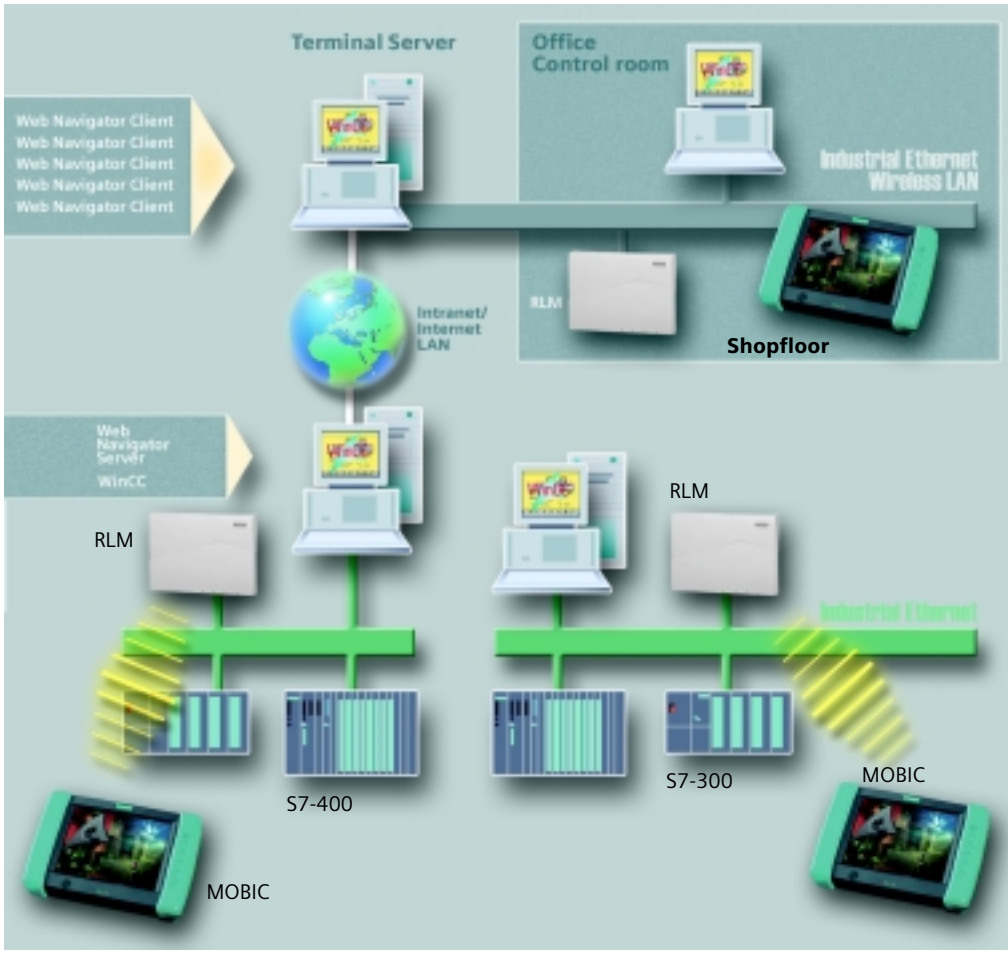

Fig. 8: Cross-factory solution with separate Web and terminal servers

Products for mobile communications
MOBIC Internet pad

The MOBIC (Mobile Industrial Communicator) as a mobile, industry-compatible Internet pad permits location-independent access to central information. Access to the data is possible via Web browsers, thin clients or application programs.
In this manner, information e.g. from the intranet/Internet, can be displayed, and mobile recording of data is also possible.

The mobile link is via a wireless LAN (IEEE802.11b) or GSM.
In the case of the wireless LAN, MOBIC communicates in the plant with wireless LAN access points (e.g. RLMs) via the PCMCIA card.

The MOBIC has the following configuration:

- A PCMCIA radio interface permits linking to wireless local networks, e.g. to the CP 1515 communications processor.
- A second PCMCIA connection for a GSM module is available to make MOBIC also appropriate for wireless WANs.
  The PCMCIA connection is also suitable for I/O devices such as barcode readers or memory expansion cards.
- Windows CE Web browser and Java Virtual Machine can be used for dialling into the local intranet or also into the World Wide Web in order to call information such as process data, diagnostics data, circuit diagrams, building plans, working instructions or product information, or to pass on data recorded locally.

Fig. 9: MOBIC Internet pad

Products for mobile communications
CP 1515 communications processor

The CP 1515 is a PCMCIA card of type II, and is used as a radio interface both in the RLM and in the mobile stations, e.g. MOBIC, SIMATIC Field PG.

Advantages of CP 1515

- Data communications free-of-charge in the 2.4 GHz ISM band
- Standardized, replaceable radio technology (PCMCIA card) according to IEEE 802.11b
- High data throughput with transmission rates up to 11 Mbit/s
- Worldwide use with comprehensive radio approvals (country-specific operating conditions must be observed)
- Simple integration of mobile stations in production assemblies
- Simple installation
- Tested in the SIMATIC TIA environment
- Simple assembly and commissioning
- Noise-insensitive reception characteristic resulting from antenna diversity
- Safe data transmission with 128 bit data coding
- Tested with MOBIC and SIMATIC Field PG

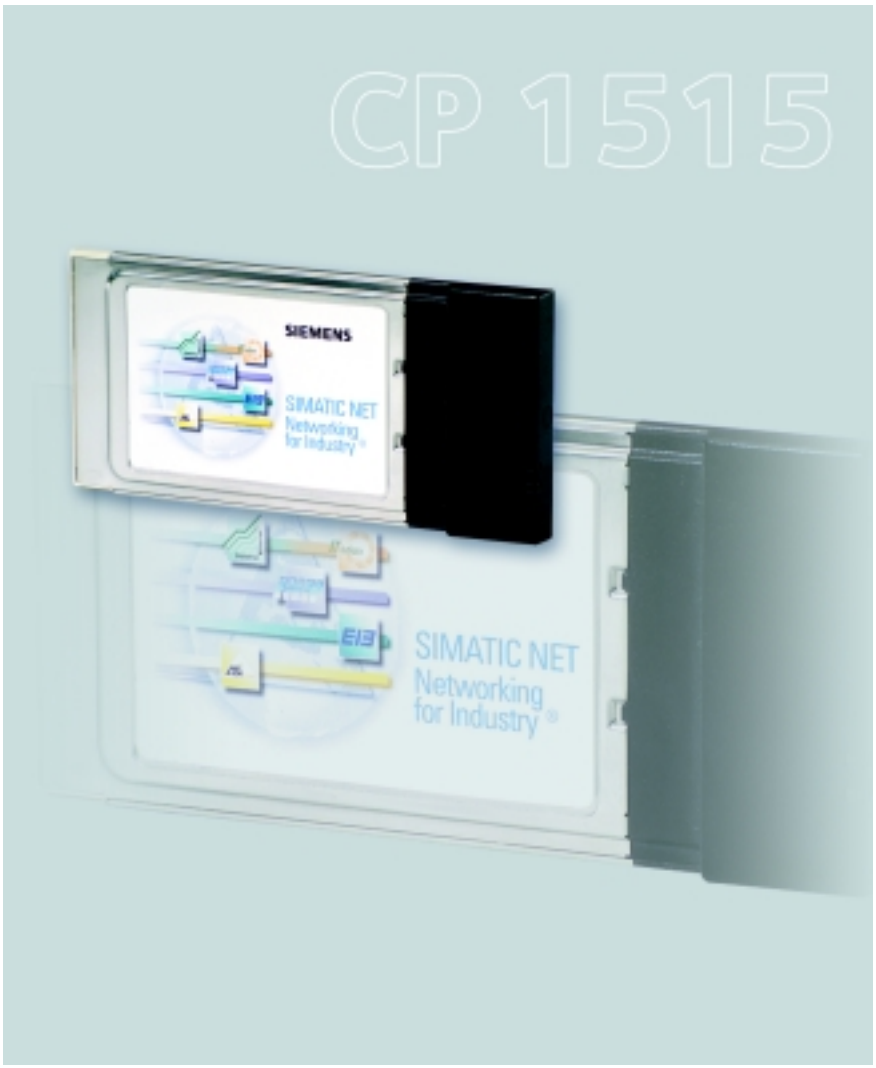

Fig. 10: CP 1515 communications processor

Products for mobile communications
RLM radio link module

The RLM access point is responsible on the one hand for managing the radio connection to the CP 1515, and, on the other, for establishing the connection to a local network. The RLM can be configured using the configuration tool "AP manager".

Advantages of RLM

- Tested in the TIA environment
- Safe investment resulting from standardized, replaceable radio technology (PCMCIA card) according to IEEE 802.11b
- Rugged metal housing
- Simple assembly and commissioning using comprehensive installation tools
- Noise-insensitive reception characteristic resulting from antenna diversity
- Safe data transmission with 128 bit data coding
- Data communications free-of-charge in the 2.4 GHz ISM band
- High data throughput with transmission rates up to 11 Mbit/s
- Worldwide use with comprehensive radio approvals (country-specific operating conditions must be observed)
- Simple integration of mobile stations in production assemblies
- Permits increase of bandwidth and redundant communication by inserting two CP 1515 modules

Fig. 11: RLM radio link module

Wireless technologies
Frequency ranges

In contrast to copper or fiber-optic cables, wireless transmission processes use air as the transmission link.
The propagation conditions of electromagnetic waves in air vary considerably depending on the room properties and the wavelength of the electromagnetic radiation.

State-of-the-art modules use techniques such as antenna diversity and high-performance receivers in order to prevent interruptions in radio traffic.

A further aspect is that air is used generally as the transmission link. This necessitates the assignment of various frequency ranges for specific applications, limitation of the maximum permissible transmission power, and selection of specific transmission procedures.

A differentiation is made in the frequency ranges of wireless technologies between:

- Personal Area Network (PAN) up to approx. 10 m radius
- Local Area Network (LAN) up to approx. 30 m to 300 m radius and
- Wide Area Network (WAN).

Current wireless networks such as Wireless LAN according to IEEE 802.11b and Bluetooth use frequency ranges in the so-called ISM bands (Industrial, Medical, Scientific Band). Data transfer rates up to 11 Mbit/s can be currently implemented using the modulation procedures selected there.

TYPE	Bluetooth	W-LAN	GSM	HSCD	GPRS	UMTS
Data transfer rate	1 Mbit/s	11 Mbit/s	9.6 kbit/s	Up to 42 kbit/s	Up to 42 kbit/s	Up to 2 Mbit/s
Available	Yes PCMCIA	Yes PCMCIA	Yes PCMCIA	Yes PCMCIA	Yes PCMCIA	In the future
Distance	Up to approx. 10 m	From approx. 30 m to 300 m	Above approx. 300 m	Above approx. 300 m	Above approx. 300 m	Above approx. 300 m

Fig. 12: Technical specifications of the various radio systems

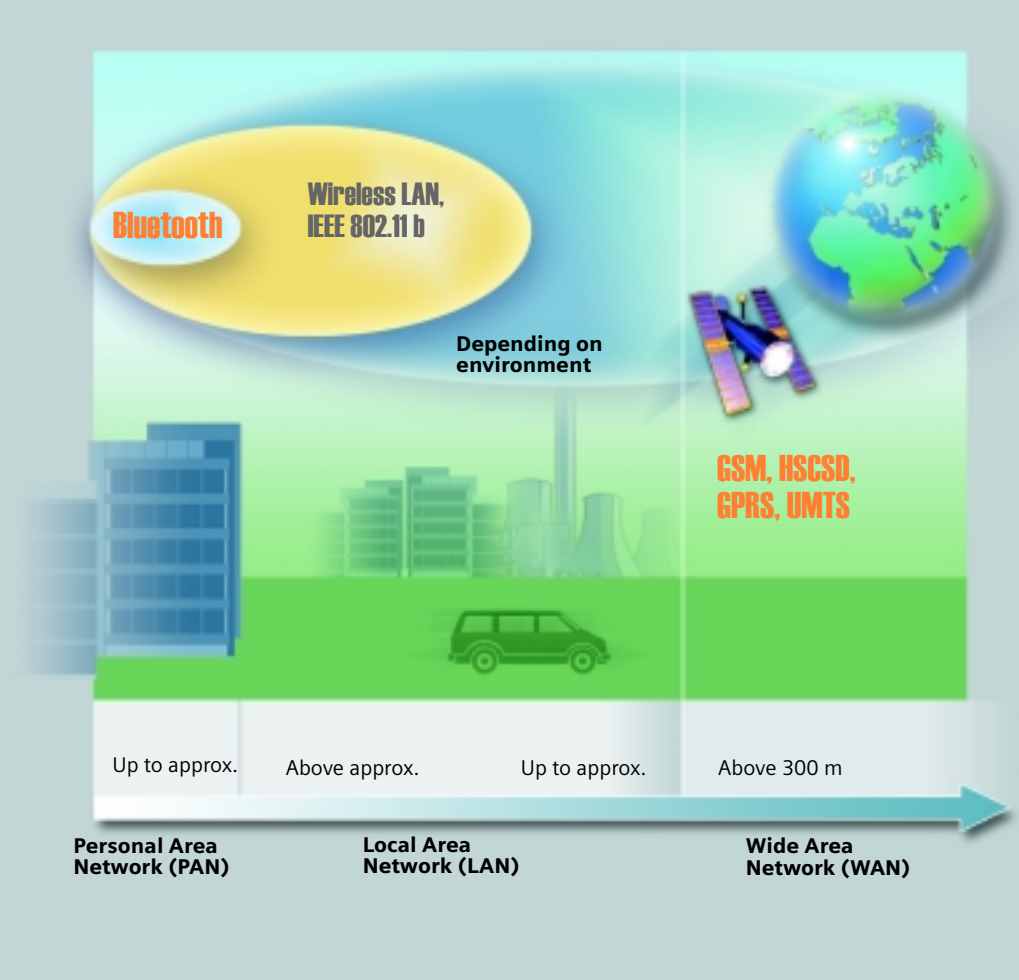

Fig. 13: Wireless networks for different application areas

Wireless technologies
Wireless networks

Bluetooth

Bluetooth is a Personal Area Network (PAN) and operates in the 2.4 GHz band with a data transfer rate of 1 Mbit/s. The range is limited to 10 m. This range, together with the limited data transfer rate, mean that Bluetooth is currently only suitable for industrial wireless LANs to a very limited extent.

Wireless LAN

Wireless LAN (WLAN) is a local radio network operating in the 2.4 GHz frequency band. WLAN products are based on the IEEE 802.11b standard with data transfer rates from 1 Mbit/s to 11 Mbit/s. The radio network is connected to a local Ethernet network using WLAN access points.

The access points transmit information within a radius of 30-300 m depending on the building properties.
Outside buildings, the transmission ranges can be significantly increased using dimensional antennae. WLAN does not require a direct visible link between the devices. Communications links can be passed on from one access point to the next (roaming). This means that even large ranges can be covered using WLAN.

GSM, HSCSD, GPRS and UMTS

These networks were primarily developed for mobile telephones. These networks therefore enable connections extending beyond countries and continents.
The differences to wireless LANs are the lower data transfer rate, and that charges are made for connections or the transmitted data quantity.

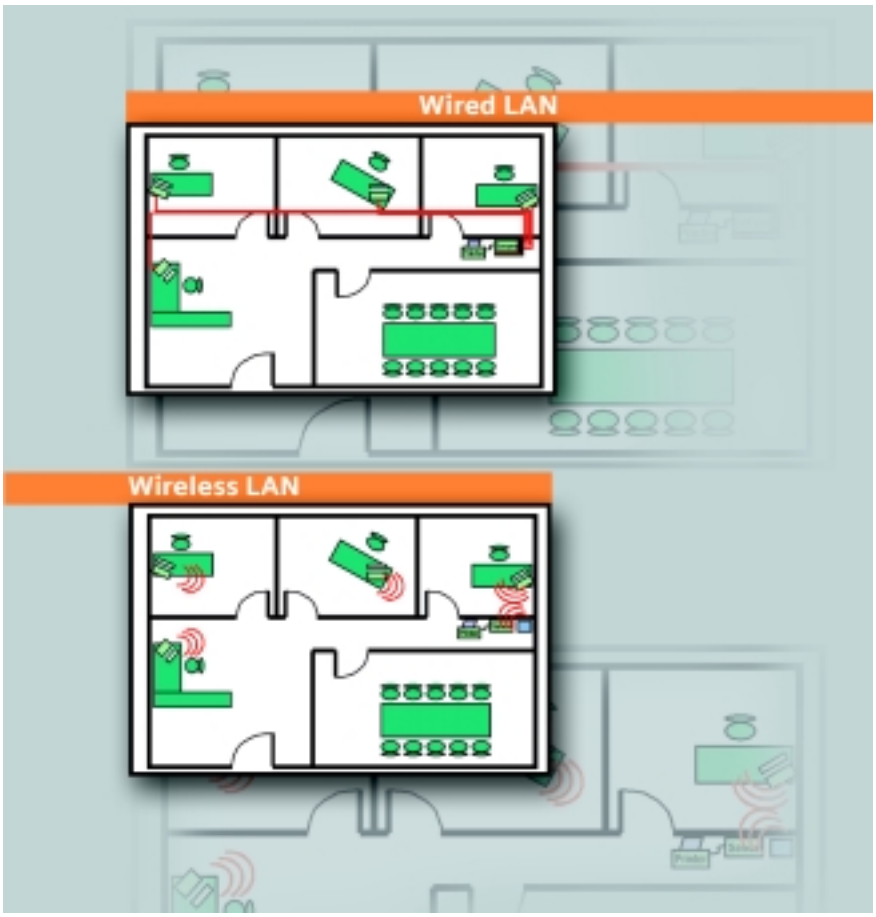

Fig. 14: Comparison between wired LAN and wireless LAN

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Glossary

Abbreviations, terms	Explanations
Access point	Wireless LANs can be connected to wired Ethernet networks via access points. In addition, the range of individual wireless LAN components can be extended by this device.
Antenna diversity	Radio receivers equipped with two antennae, permitting the receiver to select one of two received signals.
DSSS	Direct Sequence Spread Spectrum. Transmission procedure also used by devices compatible to IEEE 802.11b. One bit of the useful signal is transmitted as a code word, corresponding to multiplication (spreading) of the transmission rate.
ESD	Electrostatic discharge
ERP	Enterprise Resource Planning, z.B. SAP R3, Peoplesoft, BAAN
ESM	Electrical Switch Module; electrical network component for Industrial Ethernet with switching functions of SIMATIC NET.
GPRS	General packet radio service on the basis of GSM channels, permits fast communication with high data transfer rates, and is primarily of interest for mobile Internet access.
GPS	Satellite-based global positioning system. Using three of the total of 24 satellites, a GPS receiver can be exactly located worldwide. GPS receivers are usually incorporated in navigation systems.
IEEE	Institute of Electrical and Electronics Engineers
IEEE 802.11	Standard for radio networks in the 2.4 GHz range with transmission rates up to 2 Mbit/s.
IEEE 802.11a	Standard for radio networks in the 5 GHz range with transmission rates up to 54 Mbit/s.
IEEE 802.11b	Standard for radio networks in the 2.4 GHz range with transmission rates up to 11 Mbit/s.
ISM-Band	Industrial, Scientific and Medical Band approved for use of wireless LAN applications.
LAN	Local Area Network.
OSM	Optical Switch Module; optical network component for Industrial Ethernet with switching functions of SIMATIC NET.
PAN	Personal Area Network, comparable with an ad hoc network for small individual devices close to one another.

Glossary

Abbreviations, terms	Explanations
PCMCIA	Standard for PC plug-in cards (credit card size). PCMCIA cards (Personal Computer Memory Card International Association) are primarily used for input/output (e.g. modem) and memory expansions.
RLM	Radio Link Module; wireless LAN access point of SIMATIC NET.
Roaming	Property of wireless LAN systems which permits free movement of wireless LAN stations even beyond the limits of the radio cell of an access point. The station can transfer from one radio cell to the next without a noticeable interruption if better transmission properties exist with the latter.
SNMP	Simple Network Management Protocol; standardized protocol for transport of network management information.
Thin Client	Client computer operating in a server network. The thin client has direct access to the data and applications of all servers of the network. The applications are executed on the server, and are only "visualized" on the thin client.
TIA	Totally Integrated Automation; Siemens system for uniform configuring/programming, data management and communications.
Touch-Screen	The touch-sensitive screen of the MOBIC which recognizes the touched position on the surface (usually made using a pen) and which converts it into the desired action (e.g. movement of cursor).
USB	Standard for connection of I/O devices. USB (Universal Serial Bus) supports relatively high data transmission rates, and can be used to connect several devices to one single computer.
UMTS	Universal Mobile Telecommunications System, standard for mobile voice, audio, picture, video and data communications at a transmission rate up to 2 Mbit/s.
WAN	Wide Area Network; data network with a diameter of more than 50 km.
WinCC	Open process visualization system for operation and monitoring of SIMATIC HMI.
Wireless WAN	Communication between stations carried out by the transmission of electromagnetic waves through the air.

Further information

Ordering information	
MOBIC T8	6GK1 611-. . . . .
CP 1515 communications processor	6GK1 151-. . . . .
RLM radio link module	6GK1 110-. . . . .
Industrial Ethernet OSM ITP62	6GK1 105-. . . . .
Industrial Ethernet OSM TP62	6GK1 105-. . . . .
Industrial Ethernet OSM ITP62-LD	6GK1 105-. . . . .
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Industrial Ethernet ESM ITP80	6GK1 105-. . . . .
Industrial Ethernet ESM TP80	6GK1 105-. . . . .

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